Biomass Regression for *Liquidambar styraciflua*

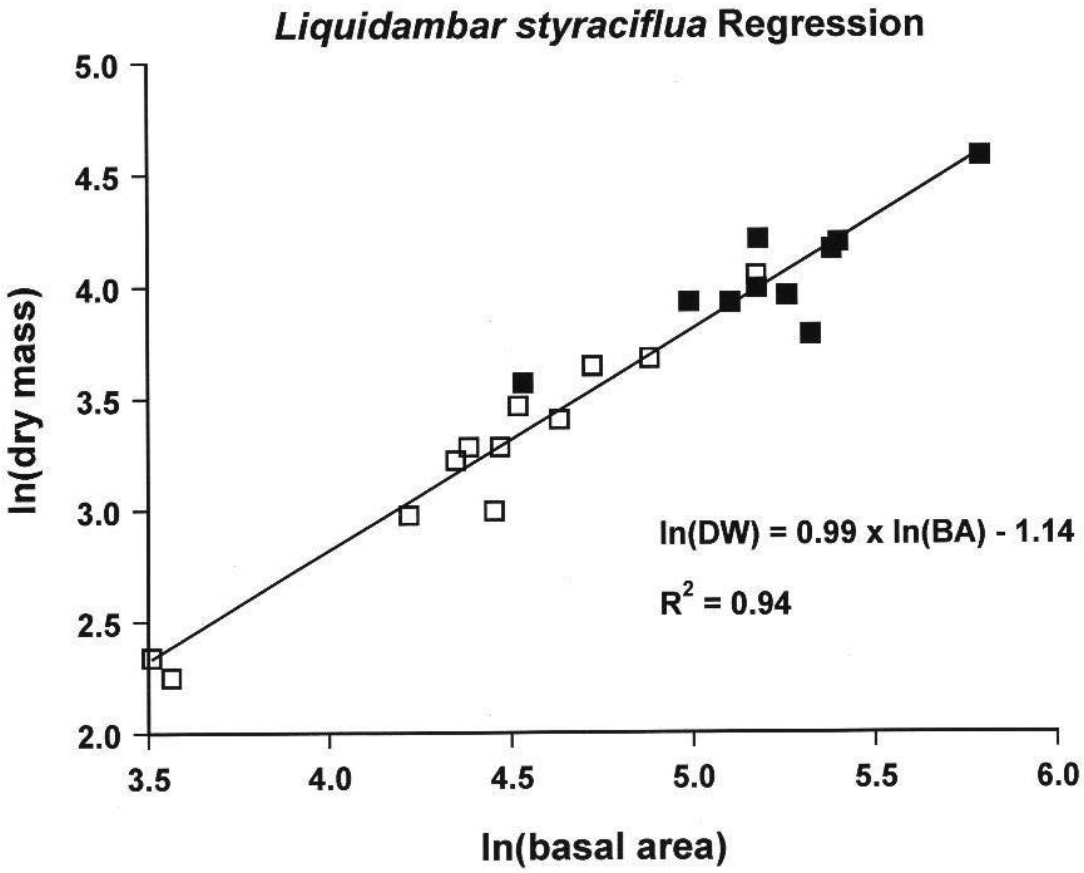
Growth response of Liquidambar styraciflua (Sweetgum) trees to elevated CO2 on the ORNL Free-Air CO2 Enrichment (FACE) facility is quantified by monthly measurements of tree diameter. These measurements are used to estimate total biomass production via mathematically-expressed allometric relationships. These relationships were established by harvesting several non-experimental trees, measuring various aspects of them, and combining these data with measurements taken some years ago from younger trees on the same plot. Ten trees were harvested, stripped of their leaves, and measured in separate components: the bole, primary and secondary branches, leaves, stump, and roots. Fresh-to-dry ratios were derived from subsamples of each section to determine the total above-ground dry mass of each tree. This information was plotted against the basal area of each tree, arriving at a relationship between the diameter and biomass similar to that documented earlier. This extended data set will be used in future research on the FACE site.

Purpose:

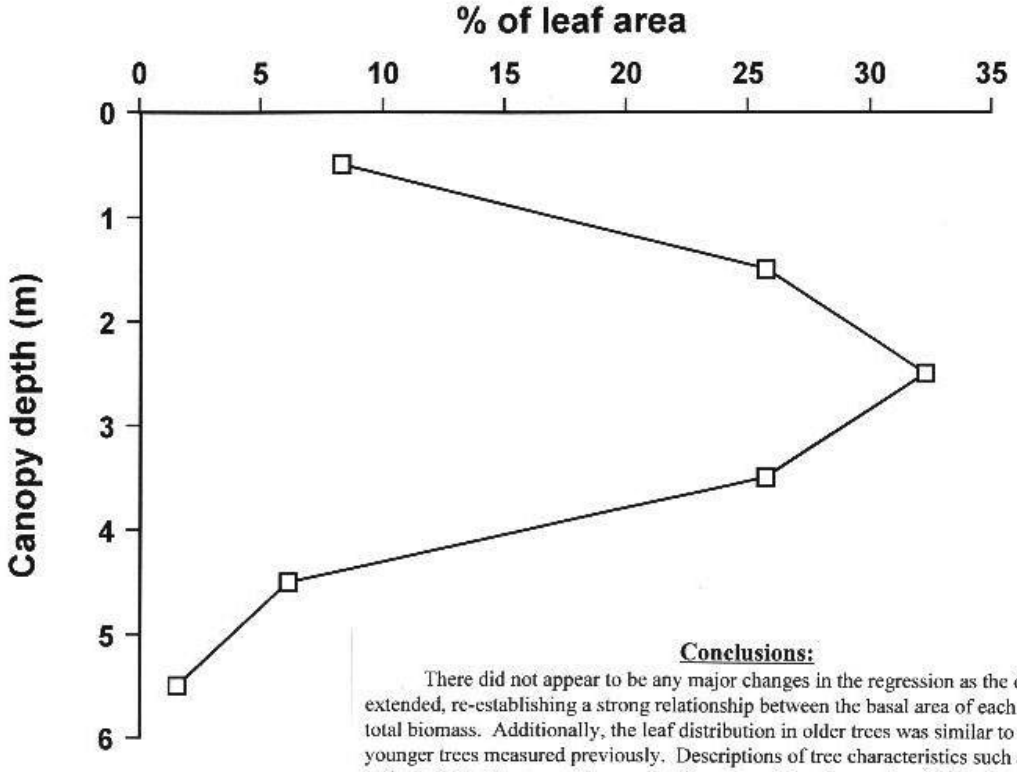
--extension of the regression to older trees on the FACE site, so that their continued growth response to elevated CO2 could be measured non-destructively
--measurement of the leaf distribution in the canopy
--below-ground harvest of root and stump so that their portion of total biomass could be determined
--estimates of tree structure, for use in calculating nutrient budgets
--to learn basic ecological research techniques
--to become more familiar with the overall framework of research relating to terrestrial ecosystems and climate change
--to get really sweaty and dirty

Plan:

--ten larger, interior, non-experimental trees were harvested
--height and circumference were measured at several locations on each tree
--leaves were stripped from each tree in 1m segments, starting at the top of the canopy
--each tree was divided into stump, bole, primary, and secondary branches, and weighed
--subsamples were taken from each section of the tree, including the leaves; a fresh-to-dry weight ratio was determined and applied to each section of the tree
--a leaf area measure was taken for each leaf subsample
--stumps and a sizable portion of the roots were harvested via a winch and much physical exertion
--total dry weight of each tree was estimated, as well as basal area of each tree and distribution of leaf mass and area throughout the canopy
--relationships were established between basal area and total dry weight
--tree structure characteristics such as bole taper and wood density were quantified


Liquidambar styraciflua Regression
5.0
4.5
4.0
3.5
3.0
2.5
2.0
ln(dry mass)
3.5
4.0
4.5
5.0
5.5
6.0
ln(basal area)
ln(DW) = 0.99 x ln(BA) - 1.14
R^2 = 0.94

Leaf Area Distribution



Conclusions:

There did not appear to be any major changes in the regression as the data set was extended, re-establishing a strong relationship between the basal area of each tree and its total biomass. Additionally, the leaf distribution in older trees was similar to that of the younger trees measured previously. Descriptions of tree characteristics such as bole taper and wood density seemed to account for some of the observed variability between trees.

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